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Commentary:clinical imaging in measuring visceral adipose tissue and other body components

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In recent years it has been recognized that not only total amount of fat,but also fat distribution plays an important role in metabolism. Visceral adipose tissue(VAT),the most important component of central obesity,is closely related to insulin resistance and hyperlipidemia. It is hypothesized that an overflow of free-fatty acid and an increased secretion of inflammatory factors toward liver impairs insulin resistance and lipid metabolism[1]. Obesity is a risk factor for many chronic diseases and obesity may interact with the underlying pathophysiology of different diseases.

1 VAT measurement techniques

Among the methods that characterize obesity,body mass index(BMI) is the most widely used tool,however BMI does not provide any information on fat distribution. Waist circumference(WC) is a proxy for central obesity but does not differentiate between VAT and subcutaneous adipose tissue(SAT). In this issue,a study compared anthropometric measures with QCT in measuring VAT. It is found that the error for WC to estimate VAT was relatively high. These findings in a Chinese sample are consistent with previous reports in western population. Some models of dual-energy X-ray absorptiometry(DXA) provide VAT reading,which are derived from DXA geometric models and are validated against VAT measured by computed tomography(CT) in cross-sectional studies. CT and magnetic resonance imaging (MRI) are the only technologies that can directly quantify VAT. VAT is quantified by using single-slice or multi-slice techniques[2]. A single-slice scan best estimates VAT at 5 to 10 cm above L4－L5,at T12－L1,or at the L1－L2 level[2-4]. Although single slice imaging is adequate in estimating total VAT in large scale cross-sectional studies,multi-slice imaging is more accurate in predicting SAT and VAT changes during weight loss[5].

2 Clinical imaging capacity on body composition measurements

Although CT and MRI are the most accurate methods in measuring VAT,they are not widely used due to the radiation involved in CT and the high cost of both CT and MRI[6]. However,CT and MRI are clinically collected for diagnosis,classification,and treatment evaluation in various diseases. Compared to imaging that is collected only for the purpose of research,clinical imaging has the advantage of adding no additional bur-

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沈溦:研究员,美国哥伦比亚大学医学院医学系和营养学院助理教授,哥伦比亚大学肥胖研究中心影像分析实验室主任、人体组成实验室副主任,是美国国立卫生院(NIH)资助的多个肥胖领域MRI和CT项目的首席科学家(Principal Investigator)。目前她的R01项目研究减肥过程中和能量代谢变化有关的器官大小变化。其最新研究方向是疾病、肥胖及人体组成的关系。目前已发表70多篇SCI同行评议文章,并和多位临床医师和科学家合作将影像学人体组成方法应用于肥胖、糖尿病、肢端肥大症、神经性厌食症、癌症、柯兴氏病、非酒精性脂肪肝炎、特发性骨质疏松、艾滋病、多囊卵巢综合征、肌萎缩等病症的研究。其领导的影像分析实验室是世界领先的人体组成影像分析的中心实验室,完成了美国和国际的多个NIH和药厂的多中心临床试验的影像分析,包括大于10万份MRI、MRS、CT和DXA的影像分析。

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den or radiation to patients. Recent advances of CT and MRI made it possible to quantify total body and regional adiposity, to map adipose tissue distribution, and to evaluate ectopic fat. Quantitative CT(QCT) has advantage of quantifying organ fat such as liver fat more accurately than conventional CT(ref). Radiomics is another emerging field that takes advantage of clinically collected image scans by post-processing tumor scans[7]. In this issue, a study found that QCT and MRI are comparable in measuring VAT and SAT. Although CT and MRI are generally considered comparable in measuring VAT, the analysis of CT is less technical demanding as CT, and is less likely to be affected by artifacts compared with MRI. In this issue, clinically collected imaging has been used to quantifying both muscle and adipose tissue.

3 Disease and Obesity

There is no controversy that obesity is a risk factor for cardiovascular diseases, diabetes, strokes, cancer, etc. In recent years it has been found that obesity may also influence the outcomes and prognoses of different diseases including cancer, chronic obstructive pulmonary disease(COPD), osteoporosis, and acromegaly. In this issue a study found that malignant gynecologic tumor patients had higher amount of fat than benign gynecologic disease. The American Society of Clinical Oncology (ASCO) position statement on obesity and cancer stated that obesity is a major risk for cancer prognosis, and is called for researching to understand the pathophysiology of obesity in cancer outcomes[8]. Recent understanding is that obesity does not translate to the same outcomes for everyone[9]. Each malignancy may be also distinctly interact with the underlying pathophysiology of obesity.

4 In summary

MRI and CT are increasingly employed in both clinical trials and clinical care. These scans are used for diagnosis, disease staging, as well as treatment evaluation. Image measured VAT as well as other body components might be used for evaluating improving disease outcomes. The digitalization and centralization of these images are allowed for clarifying obesity related questions in various diseases. Imaging offers enormous opportunities in obesity care and prevention in diseases.

参考文献

[1] Björntorp P. Classification of obese patients and complications related to the distribution of surplus fat[J]. Nutrition, 1990, 6(2):131-137.

[2] Shen W, Punyanitya M, Chen J, et al. Visceral adipose tissue: relationships between single slice areas at different locations and obesity-related health risks[J]. Int J Obes (Lond), 2007, 31(5):763-769.

[3] Shen W, Punyanitya M, Wang ZM, et al. Visceral adipose tissue: relations between single-slice areas and total volume[J]. Am J Clin Nutr, 2004, 80(2):271-278.

[4] Irlbeck T, Massaro JM, Bamberg F, et al. Association between single-slice measurements of visceral and abdominal subcutaneous adipose tissue with volumetric measurements: the Framingham Heart Study[J]. Int J Obes (Lond), 2010, 34(4):781-787.

[5] Shen W, Chen J, Gantz M, et al. A Single MRI slice does not accurately predict visceral and subcutaneous adipose tissue changes during weight loss[J]. Obesity (Silver Spring), 2012, 20(12):2458-2463.

[6] Shen W, Wang ZM, Punyanita M, et al. Adipose tissue quantification by imaging methods: a proposed classification[J]. Obes Res, 2003, 11(1):5-16.

[7] Aerts HJ, Velazquez ER, Leijenaar RT, et al. Decoding tumour phenotype by noninvasive imaging using a quantitative radiomics approach[J]. Nat Commun, 2014(5):4006.

[8] Ligibel JA, Alfano CM, Courneya KS, et al. American Society of Clinical Oncology position statement on obesity and cancer[J]. J Clin Oncol, 2014, 32(31):3568-3574.

[9] Azvolinsky A. Cancer prognosis: role of BMI and fat tissue[J]. J Natl Cancer Inst, 2014, 106(6):dju177.

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统计资料类型

统计资料共有三种类型:计量资料、计数资料和等级资料。按变量值性质可将统计资料分为定量资料和定性资料。

定量资料又称计量资料,指通过度量衡的方法,测量每一个观察单位的某项研究指标的量的大小,得到的一系列数据资料,其特点为具有度量衡单位、多为连续性资料、可通过测量得到,如身高、红细胞计数、某一物质在人体内的浓度等有一定单位的资料。

定性资料分为计数资料和等级资料。计数资料为将全体观测单位(受试对象)按某种性质或特征分组,然后分别清点各组观察单位(受试对象)的个数,其特点是没有度量衡单位,多为间断性资料,如某研究根据患者性别将受试对象分为男性组和女性组,男性组有72例,女性组有70例,即为计数资料。等级资料是介于计量资料和计数资料之间的一种资料,可通过半定量的方法测量,其特点是每一个观察单位(受试对象)没有确切值,各组之间仅有性质上的差别或程度上的不同,如根据某种药物的治疗效果,将患者分为治愈、好转、无效或死亡。